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Adverse ambient conditions for switchgear: the flotation systems used in potassium chloride extraction at the K+S potash works in NeuhoF-Ellers

Emergency pull-wire switches

Machine safety in extreme environments

At its NeuhoF-Ellers site near Fulda, the company K+S Kali mines raw potash and magnesium salts at depths of down to 800 metres. The atmosphere in the flotation plants which separate the potassium chloride from the rock salt and other mineral salt constituent parts is extremely corrosive. Trust is therefore placed in "Extreme" emergency pull-wire switches which have been thoroughly tested and which allow the plants to be switched off very fast should a dangerous situation occur.

Far below the surface of the earth, at a depth of 540 to 780 metres, Upper Permian deposits are to be found in the eastern parts of Hesse and Thuringia: raw potash and magnesium salts which K+S Kali has been mining for decades.

Potash does not play a direct role in human nutrition, but its indirect importance is all the greater for it. Without potash, basic plant products such as grain would be almost impossible to farm

economically, and the resulting yield would be considerably lower.

In the Neuhoef-Ellers mine, around 20 km west of Fulda, there is also a third, much rarer salt: here kieserite is mined – a mineral containing magnesium and sulphurous material (magnesium sulphate), which is ideally suited as a fertiliser for certain crops because it not only generally strengthens the plants, but also prevents chlorosis, a deficiency disease.

Fertiliser extraction from a depth of 700 m

K+S is thus making an important contribution to feeding the growing world population. The company is one of the largest potash producers and is a leading salt supplier worldwide. Products sold include Korn-Kali[®], 60er Kali[®], ESTA[®] kieserite and Magnesia-Kainit[®].

In Neuhoef-Ellers, the mined raw salt is first separated electrostatically into its kieserite and residual mineral components using the patented energy-saving and dry ESTA[®] process. This process is performed on a huge scale: with a daily capacity of 12,500 tonnes. Every year the potash plant generates up to 1.4 million tonnes of standard and specialised fertilisers.

In a second step, potassium chloride is extracted from the residue of the ESTA[®] plant by means of flotation. The precursor is a salt suspension in a saturated saline solution, into which air is blown. Special flotation agents cause the air bubbles to attach themselves only to the potassium chloride for separation purposes, and then to swim to the surface as foam. This foam is then removed and, in a further step, dried.

K+S operates a total of six two-stage flotation systems in Neuhoef-Ellers. Safety



The flotation systems are safeguarded using emergency pull-wire switches

measures include multiple emergency pull-wire switches, each one installed alongside the basin and spanning a distance of about 10 metres. They enable the staff on site to stop a dangerous machine movement immediately, without having to walk to an emergency-stop button installed in an operating panel. In an emergency, this can save precious seconds.

Originally, K+S used one-sided emergency pull-wire switches from various manufacturers in its plants. Regular safety checks repeatedly revealed failures. One of the responsibilities of Christoph Hachfeld, Operational Engineer for Electrotechnology, is electrical maintenance and repair of the flotation systems: "The reason why the emergency switches failed was usually corrosion of the plunger: pulling the wire then has no effect."

The reason for this is obvious: the saline solution in the flotation basins has a temperature of around 40 °C and is extremely corrosive. It is unavoidable that salty splashes or at least minute drops of this saline solution fall onto the emergency

stop switch. The constantly high humidity in the flotation plants exacerbates the corrosive atmosphere, as confirmed by Hachfeld: "The conditions here are even more unfavourable than in a typical saltwater environment. Even V2A stainless steels corrode here very fast. The salty, foggy, fluid droplets also attack the interior of e.g. switches if they are not effectively sealed."

When Hachfeld assumed responsibility for maintenance of the production plants about three years ago, he looked up the relevant providers and researched emergency pull-wire switches for extreme ambient conditions. This led him to the steute "Extreme" range.

This range includes several series of emergency pull-wire switches for extreme environments, one of which is the ZS 73. Its

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Christoph Hachfeld, K+S Kali

die-cast aluminium housing is hard-coated, and an additional sealing cuff prevents dirt from penetrating. The exterior metal components and accessories, such as the pull-wire unit, screws, thimble and wire, are made out of V2A and V4A stainless steel.

Refit after 1-year test phase

K+S started by ordering a single ZS 73 in the "Extreme" version described above and testing it for one year. The result: the emergency pull-wire switch functioned in these extreme conditions with no problems for the entire 12 months. The surface operations maintenance team in Neuhof then refitted all its flotation systems with the ZS 73. Since then, they have been working hard in the name of machine safety without any malfunctioning at all - even though the adverse ambient conditions are clearly in evidence.

Tip for bulk goods and solids!

Compact and safe design

At the POWTECH 2019, the new steute solenoid interlock for gas and dust explosive zones was presented for the first time ever. The features of this Ex STM 298-3 GD safety switch include a very compact, slim design, making it well suited to mounting on machine profile systems and in narrow installation locations. Inside the die-cast aluminium housing there is a robust switching system which guarantees locking of the guard door. Here high locking forces are achieved (up to 3000 N for straight and sliding actuators).

Machine operators are thus reliably prevented from opening the guard door before all dangerous movements have stopped.

The new solenoid interlock is also very versatile because it is available with different actuators (straight, angled and sliding) and because the actuator head can be adjusted in 90° steps. Users also have a choice of switching inserts: the range includes a variety of normally open and normally closed contacts.

In addition, the new device can be used in applications with a high switching frequency and in adverse environments up to IP67.

The Ex STM 298-3GDG is ATEX approved for gas Ex zone 2 and dust Ex zone 22. Typical applications for the dust Ex approved variant, presented at the POWTECH for the first time, include the safeguarding of doors on manufacturing, filling and packaging machines handling dust-raising products or powdery goods.

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